Synthetic Data Set Results

Overview of how well UNMIX and PMF reproduced “known” sources.

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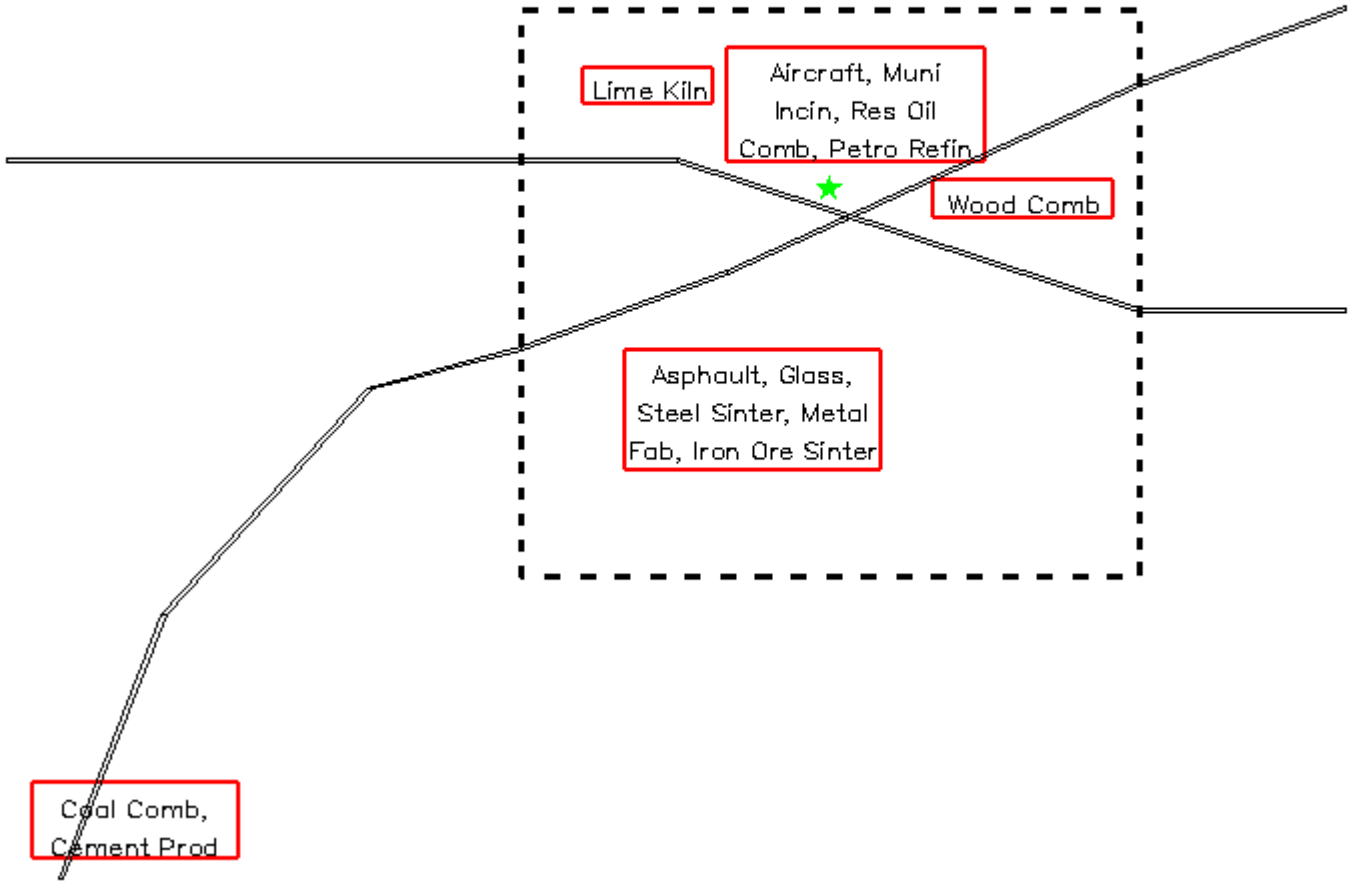
Overview of Synthetic Data

- **ISC3ST dispersion model**
- **1984 DC meteorological data**
- **City layout - 16 unique sources**
  - **9 point sources (stacks)**
  - **4 industrial complexes**
  - **1 area source**
  - **2 types of highways**

Sources in Synthetic Data (avg. contribution)

- **Point Sources (SPECIATE)**
  - **Resid. Oil Comb (5.4)**
  - **Coal Comb. (1.5)**
  - **Municipal Incin. (1.0)**
  - **Lime Kiln (0.8)**
  - **Petroleum Refin. (0.8)**
  - **Iron Ore Dust-Sinter (0.4)**
  - **Glass Furnace (0.3)**
  - **Metal Fabrication (0.3)**
  - **Wood Combustion (0.1)**
- **Industrial Complexes (CARB)**
  - **Aircraft - Jet Fuel (1.0)**
  - **Steel Sinter (0.8)**
  - **Asphalt Roofing (0.4)**
  - **Cement Production (0.1)**
- **Area/Mobile (DRI + CARB)**
  - **Area : local traffic + dust (28.1)**
  - **Inner Highway: local traffic (28.1)**
  - **Outer Highway: highway traffic (0.8)**

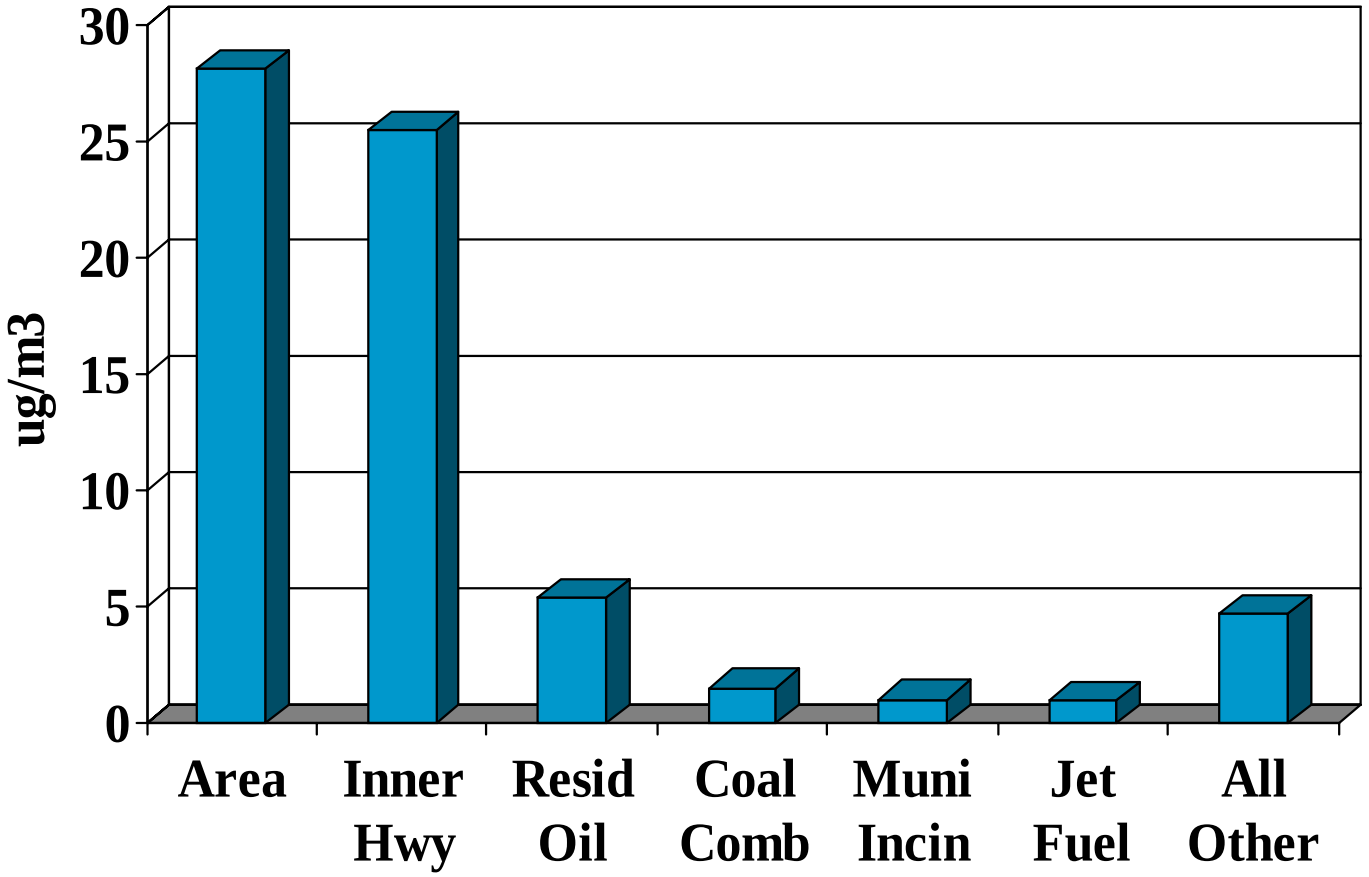
View of Point Sources, Industrial Complexes, and Highways in Palookaville



Average Contribution by Source Category

Contribution (ug/m3)	Source
67.1	Overall average
28	Area (incl. local traffic)
25.5	Inner Highway
5.4	Residual oil combustion
1.5	Coal combustion
~1 each	Municipal incineration & Jet fuel
< 1 each	All others

Average Contribution by Source Category



Materials Provided to Analysts

- **Map of area**
- **Hourly meteorological data**
  - **wind speed and direction**
  - **mixing height**
  - **temperature**
  - **stability index**
- **Daily ambient concentrations at receptor**
  - **50 species + mass (MDLs and uncertainties provided)**
  - **4 species identically 0**
  - **3 species entirely < MDL**
- **Profiles for 22 sources**
  - **15 of 16 unique sources (coal combustion left out)**
  - **7 extraneous sources (3 addl. area profiles, 2 addl. road profiles, 2 addl. point profiles)**

Materials Received from Analysts

- **File containing source profiles**
- **File containing daily source contributions**
- **Written description identifying the sources and explaining why source identified as they were**

(Different UNMIX solutions were provided. Five-source, 6-source, and 7-source solutions. The following is based on the 7-source solution.)

Sources Identified by Analysts

(avg. contribution)

UNMIX

- **4 larger than error**
  - **Soil (28)**
  - **Vehicles (25)**
  - **Resid. Oil Comb. (5)**
  - **Combustion (4)**
- **3 within noise**
  - **Asphalt Roofing (2)**
  - **Palladium Source (3)**
  - **Steel Sinter + stuff (6)**
- **Used ~25 species + mass**
- **Used meteorology**

PMF

- **9 sources**
  - **Area (26)**
  - **Inner Hwy (24)**
  - **Resid Oil Comb. (6)**
  - **Lime Kiln (5)**
  - **Extra Area Sources (2)**
  - **Steel Sinter (2)**
  - **Municipal Incin. (1)**
  - **Asphalt Roofing (1)**
  - **Petro. Refin. (1)**
- **Used 50 species + mass**

Comparison to Known Profiles

- **Sources identified by both tools**

  (known / UNMIX / PMF)

  - **Area/Soil/Area** **28 / 28 / 26**
  - **Inner Hwy/Vehicle/Inner Hwy** **26 / 25 / 24**
  - **Residual Oil Combustion** **5 / 5 / 6**
  - **Steel Sinter** **0.8 / 6 / 1.5**
  - **Asphalt Roofing** **0.4 / 2 / 2**

- **Sources identified by UNMIX only**
  - **Palladium source (~3)**
  - **Combustion source located to NE of site (~4)**

- **Sources identified by PMF only**

  (known / PMF)

  - **Muni. Incin./ Muni. Incin** **1 / 1**
  - **Petro. Refin. / Petro. Refin.** **0.8 / 1**
  - **Lime kiln / Lime kiln** **0.8 / 5**
  - **Coal Comb. / Extra Area** **1.5 / 2**

Conclusions

- **Largest 3 known sources correctly identified and associated mass close to simulated mass**
- **4th largest known source, coal combustion located SW of receptor, was not identified (presence of source withheld from analysts)**
  - **UNMIX did not find source**
  - **PMF has profile similar to source but it was identified as extra area source.**
- **3-4 smaller known point sources identified but masses associated with them are larger than simulated masses**